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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/572,524	09/11/2007	Xuejun Kang	7989P001	4739

8791 7590 03/01/2011

BLAKELY SOKOLOFF TAYLOR & ZAFMAN LLP
1279 OAKMEAD PARKWAY
SUNNYVALE, CA 94085-4040

EXAMINER	
JOY, JEREMY J	

ART UNIT	PAPER NUMBER
2822	

MAIL DATE	DELIVERY MODE
03/01/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/572,524	KANG ET AL.	
	Examiner	Art Unit	
	Jeremy J. Joy	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 December 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,9,10,12,14-16,18-21,23-28,31,34-36,38-48 and 52-57* is/are pending in the application.

4a) Of the above claim(s) *1-6, 9-10, 12, 14-16, 18-21, 23-28, and 47-48* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *31,34-36,38-46 and 52-57* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/16/2010*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's amendment to the claims filed on 12/16/2010 has been acknowledged and entered. Claims 29-30 and 50-51 have been cancelled. Final Action on the merits is as follows:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims **31, 35, 38-43, 45-46, 52-54 and 56-57** are rejected under 35 U.S.C. 103(a) as being unpatentable over *Park et al.* (**U.S. Patent Pub. No. 2005/0173692**, from hereinafter "*Park*") in view of *Chen et al.* (**U.S. Patent Pub. No. 2002/0137243**, from hereinafter "*Chen*") in further view of *Held* (**U.S. Patent Pub. No. 6,509,270**).

Regarding Claim 31, *Park* teaches a light emitting device comprising epitaxial layers, a first ohmic contact on a first surface of the epitaxial layers; a reflective adhesive layer on the first ohmic contact layer; a conductive substrate attached to the reflective adhesive layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces (Fig. 3, epitaxial layers 35, ohmic contact

layer 32, reflective adhesive layer 34, conductive substrate 41, second ohmic contact layer 49; ¶'s 0043-0052).

Park fails to teach the conductive substrate is a layer of thermally conductive metal electroplated onto the device.

Chen teaches a similar light emitting device wherein a conductive substrate made of a layer of thermally conductive metal electroplated on the device (Fig. 4-6, thick metal layer 70; ¶ 0030-0032).

In view of the teachings of *Chen*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park* to include the conductive substrate is a thermally conductive electroplated metal because this substrate, as stated by *Chen*, "capable of supporting those epitaxial layers because of its less fragile characteristic compared with properties of semiconductor."

Park, as modified by *Chen* above fails to specifically teach a seed layer formed on the stacked structure between the electroplated metal layer and the reflective adhesive layer.

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park*, as modified by *Chen* above to include a seed layer formed on the reflective adhesive layer of thermally conductive material because the seed layer helps with reliability of the

relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 35, although *Park*, as modified by *Chen* and *Held* above fails to teach the size of the ohmic contact layers, *Chen* does teach the ohmic contact layer as claimed and discloses the size of the thermally conductive metal layer providing a scale at which the claimed range would fall in when forming a thinner ohmic contact layer. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include that the ohmic electrode could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Regarding Claim 38, as in the combination of claim 31 above, *Chen* and *Held* both teach forming copper electroplated thermally conductive layers and *Park* teaches the epitaxial layers comprise multiple GaN-related epitaxial layers (Fig. 3a, ¶ 0043-0044).

Regarding Claim 39, *Park* teaches the light emitting device is a light emitting diode.

Regarding Claim 40, *Park* teaches the first ohmic contact layer at its interface with the epitaxial layers is a mirror (¶ 0046).

Regarding Claim 41, *Park* teaches a light emitting device comprising epitaxial layers, a first ohmic contact on a first surface of the epitaxial layers; a reflective adhesive layer on the first ohmic contact layer; a conductive substrate attached to the reflective adhesive layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are opposite surfaces; and wherein the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror (Fig. 3, epitaxial layers 35, ohmic contact layer 32, reflective adhesive layer 34, conductive substrate 41, second ohmic contact layer 49; ¶'s 0043-0052).

Park fails to teach the conductive substrate is a layer of thermally conductive metal electroplated onto the device.

Chen teaches a similar light emitting device wherein a conductive substrate made of a layer of thermally conductive metal electroplated on the device (Fig. 4-6, thick metal layer 70; ¶ 0030-0032).

In view of the teachings of *Chen*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park* to include the conductive substrate is a thermally conductive electroplated metal because

this substrate, as stated by *Chen*, "capable of supporting those epitaxial layers because of its less fragile characteristic compared with properties of semiconductor."

Park, as modified by *Chen* above fails to specifically teach a seed layer formed on the stacked structure between the electroplated metal layer and the reflective adhesive layer.

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park,* as modified by *Chen* above to include a seed layer formed on the reflective adhesive layer of thermally conductive material because the seed layer helps with reliability of the relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 42, as in the combination of claim 41 above, *Chen* teaches the layer of thermally conductive metal is a mechanical support (¶ 0030).

Regarding Claim 43, although *Park*, as modified by *Chen* and *Held* above fails to teach the size of the ohmic contact layers, *Chen* does teach the ohmic contact layer as claimed and discloses the size of the thermally conductive metal layer providing a scale at which the claimed range would fall in when forming a thinner ohmic contact layer. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the

invention it would have been obvious to include that the ohmic electrode could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Regarding Claim 45, as in the combination of claim 31 above, *Chen* and *Held* both teach forming copper electroplated thermally conductive layers and *Park* teaches the epitaxial layers comprise multiple GaN-related epitaxial layers (Fig. 3a, ¶ 0043-0044).

Regarding Claim 46, *Park* teaches the light emitting device is a light emitting diode.

Regarding Claim 52, *Park* teaches a light emitting device comprising multiple epitaxial layers comprising an active layer, a first surface of the multiple epitaxial layers having a first ohmic contact layer thereon; a reflective adhesive layer on the first ohmic contact layer; a conductive substrate attached to the reflective adhesive layer, and a second ohmic contact layer on a second surface of the epitaxial layers, wherein the first surface of the epitaxial layers and the second surface of the epitaxial layers are

opposite surfaces (Fig. 3, epitaxial layers 35, ohmic contact layer 32, reflective adhesive layer 34, conductive substrate 41, second ohmic contact layer 49; ¶'s 0043-0052).

Park fails to teach the conductive substrate is a layer of thermally conductive metal electroplated onto the device.

Chen teaches a similar light emitting device wherein a conductive substrate made of a layer of thermally conductive metal electroplated on the device (Fig. 4-6, thick metal layer 70; ¶ 0030-0032).

In view of the teachings of *Chen*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park* to include the conductive substrate is a thermally conductive electroplated metal because this substrate, as stated by *Chen,* "capable of supporting those epitaxial layers because of its less fragile characteristic compared with properties of semiconductor."

Park, as modified by *Chen* above fails to specifically teach a seed layer formed on the stacked structure between the electroplated metal layer and the reflective adhesive layer.

Held however teaches forming a seed layer of a thermally conductive metal onto the surface of a device where a relatively thick layer of the thermally conductive metal will be formed prior to the electroplating process (Fig. 5, layer 12; Col. 13, lines 40-59).

In view of the teachings of *Held*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park,* as modified by *Chen* above to include a seed layer formed on the reflective adhesive layer of thermally conductive material because the seed layer helps with reliability of the

relatively thick layer being formed onto the ohmic electrode and also facilitates proper formation of the relatively thick layer during a formation process requiring electrodeposition.

Regarding Claim 53, as in the combination of claim 52 above, *Chen* teaches the layer of thermally conductive metal is a mechanical support (¶ 0030).

Regarding Claim 54, although *Park*, as modified by *Chen* and *Held* above fails to teach the size of the ohmic contact layers, *Chen* does teach the ohmic contact layer as claimed and discloses the size of the thermally conductive metal layer providing a scale at which the claimed range would fall in when forming a thinner ohmic contact layer. In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include that the ohmic electrode could be formed to be in the range of 3 to 500 nm because the ohmic electrodes should be formed small enough so that they don't increase the resistance in the device but large enough, so that they provide a strong electrical contact to the epitaxial layers. Furthermore, the applicant has not established the critical nature of this range. "The law is replete with cases in which the difference between the claimed invention and the prior art is some range or other variable within the claims. . . . In such a situation, the applicant must show that the particular range is critical, generally by showing that the claimed range achieves unexpected results relative to the prior art range." *In re Woodruff*, 919 F.2d 1575, 16 USPQ2d 1934 (Fed. Cir. 1990).

Regarding Claim 56, as in the combination of claim 1 above, *Chen* and *Held* both teach forming copper electroplated thermally conductive layers and *Park* teaches

the epitaxial layers comprise multiple GaN-related epitaxial layers (Fig. 3a, ¶ 0043-0044).

Regarding Claim 57, *Park* teaches the light emitting device is a light emitting diode.

1. Claims **34, 36, 44 and 55** are rejected under 35 U.S.C. 103(a) as being unpatentable over *Park*, as modified by *Chen* and *Held* above, and further in view of *Lee et al.* (**U.S. Patent Pub. No. 2003/0189215**, from hereinafter "*Lee*").

Regarding Claim 34, *Park*, as modified by *Chen* and *Held* above fails to teach the layer of thermally conductive metal is at least 50μm thick.

Lee however discloses in a similar device having a layer of thermally conductive metal formed on a light emitting device comprising epitaxial layers and the first and second ohmic contact layers as claimed that the layer of thermally conductive metal is at least 50μm thick (¶ 0041).

In view of the teachings of *Lee*, it would have been obvious to a person having ordinary skill in the art at the time of the invention to modify the teachings of *Park*, as modified by *Chen* and *Held* above to include the thickness of the thermally conductive metal layer to be at least 50μm thick because the thicker the metal layer the greater amount of mechanical support and heat dissipation it can provide for the device. Also, it has been held that where the general conditions of a claim are disclosed in the prior art, discovering optimum or working ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding Claim 36, 44 and 55, *Park*, as modified by *Chen* and *Held* above fails to teach the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, and includes bonding pads.

Lee however teaches in one embodiment an ohmic contact layer selected from a group consisting of: opaque, transparent, and semi-transparent, and includes bonding pads (Fig. 1, ohmic contact layer 32, bonding pads 34/36; ¶ 0012).

In view of the teachings of *Lee* and with ordinary skill in the art at the time of the invention it would have been obvious to include the second ohmic contact layer is selected from a group consisting of: opaque, transparent, and semi-transparent, and includes bonding pads because these properties of a ohmic contact layer will help improve the light emission of the device and the bonding pads will help provide strong electrical contact to the ohmic layer and to the rest of the device.

Response to Arguments

2. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jeremy J. Joy whose telephone number is (571)270-7445. The examiner can normally be reached on Monday - Friday, 8am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on (571)-272-2429. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jeremy J. Joy/
Examiner, Art Unit 2822
February 28, 2011

/Zandra V. Smith/
Supervisory Patent Examiner, Art Unit 2822

/M. Wilczewski/
Primary Examiner, Art Unit 2822